

What is claimed is:

1. An immersion silver plating bath composition comprising one or more sources of silver ions, water, one or more complexing agents and one or more carboxylic acid-substituted nitrogen-containing heterocyclic compounds, wherein the bath is free of ammonia and ammonium ions.
2. The composition of claim 1 wherein the bath has a pH of ≥ 7 .
3. The composition of claim 1 wherein the bath has a pH of ≥ 8.5 .
4. The composition of claim 1 wherein the carboxylic acid-substituted nitrogen-containing heterocyclic compound is chosen from picolinic acid, quinolinic acid, nicotinic acid, fusaric acid, isonipecotic acid, nipecotic acid, pyridine dicarboxylic acid, piperazine carboxylic acid, pyrrole carboxylic acid and piperolinic acid.
5. The composition of claim 1 wherein the carboxylic acid-substituted nitrogen-containing heterocyclic compound comprises a nitrogen-containing heterocyclic moiety chosen from pyridine, piperidine, piperazine, pyrrole, morpholine, pyrrolidine, triazole, and imidazole.
6. The composition of claim 1 wherein at least one complexing agent is a multidentate ligand.
7. The composition of claim 1 wherein at least one complexing agent is chosen from cyanide, pyridine; amino acids having from 2 to 10 carbon atoms; polycarboxylic acids; amino acetic acids; pyridine carboxylic acid and pyridine dicarboxylic acid; alkylene polyamine polyacetic acids, polyamines; citrates; tartrates; N,N-di-(2-hydroxyethyl)glycine; gluconates; lactates; crown ethers; cryptands; polyhydric compounds; heteroaromatic compounds; thio-containing ligands and aminoalcohols.
8. A method of depositing a layer of silver on a substrate comprising the step of contacting a substrate having a layer of a metal that is less electropositive than silver with an immersion silver plating bath comprising one or more sources of silver ions, water, one or more complexing agents and one or more carboxylic acid-substituted nitrogen-containing heterocyclic compounds, wherein the bath is free of ammonia and ammonium ions.
9. The method of claim 8 wherein the bath has a pH of ≥ 7 .

10. The method of claim 8 wherein the bath has a pH of ≥ 8.5 .
11. The method of claim 8 wherein the carboxylic acid-substituted nitrogen-containing heterocyclic compound is chosen from picolinic acid, quinolinic acid, nicotinic acid, fusaric acid, isonipecotic acid, nipecotic acid, pyridine dicarboxylic acid, piperazine carboxylic acid, pyrrole carboxylic acid and piperolinic acid.
12. The method of claim 8 wherein the carboxylic acid-substituted nitrogen-containing heterocyclic compound comprises a nitrogen-containing heterocyclic moiety chosen from pyridine, piperidine, piperazine, pyrrole, morpholine, pyrrolidine, triazole, and imidazole.
13. The method of claim 8 wherein at least one complexing agent is a multidentate ligand.
14. The method of claim 8 wherein at least one complexing agent is chosen from cyanide, pyridine; amino acids having from 2 to 10 carbon atoms; polycarboxylic acids; amino acetic acids; pyridine carboxylic acid and pyridine dicarboxylic acid; alkylene polyamine polyacetic acids, polyamines; citrates; tartrates; N,N-di-(2-hydroxyethyl)glycine; gluconates; lactates; crown ethers; cryptands; polyhydric compounds; heteroaromatic compounds; thio-containing ligands and aminoalcohols.
15. A method of improving the thickness uniformity of a layer of silver deposited from an immersion silver plating bath comprising the steps of: a) providing an immersion silver plating bath comprising one or more carboxylic acid-substituted nitrogen-containing heterocyclic compounds, one or more sources of silver ions, water and one or more complexing agents; and b) contacting a substrate having a metal layer that is less electropositive than silver with the immersion silver plating bath for a period of time sufficient to deposit a desired silver layer.